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## Some Special Points on the Performance of Autopsies on the New-born.<sup>1</sup>

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I SHALL take the opportunity to-day, gentlemen, of showing you the method of performing a post-mortem upon a babe, as the technique is somewhat different from that with which you are now familiar in the case of an adult.

In the external examination of the body you should especially look for signs of inflammation of the cord, ophthalmia neonatorum, hæmatoma, dislocations and fractures, the state of the fontanelles, mastitis, hernia, especially umbilical, spina bifida, pemphigus, thrush, icterus, cyanosis and malformations, such as hare-lip, cleft palate, tongue-tie, polydactylism, monstrosities, abnormal openings, imperforate anus and rectum, etc.

A curious and rather amusing circumstance occurred some years ago, in connection with one of my autopsies in the city. A child came on the post-mortem table two days after birth, and the autopsy revealed a complete imperforate rectum, the

anus being likewise imperforate. The physician in charge had ordered immediately after birth that a glycerine suppository should be administered morning and evening. The nurse reported each time the carrying out of the order. Whether or not she also stated that the child had had a passage each time I do not know.

According to Orth, the mean height of a full-term, sound child is between fifty and fifty-one centimetres, the male being slightly longer than the female. The weight of a full-term boy at birth is 3600 grammes, of a girl 3250 grammes. For the last five lunar months of foetal life, if the height expressed in centimetres be divided by five, the approximate age of the child in lunar months will be obtained. For example, if the child measures thirty-five centimetres, divide this by five, and we have seven as the number of lunar months which the child has passed in utero. The foetal age of the child in the first five months represents about the square root of the height, expressed in centimetres. For example, if the

<sup>1</sup> Remarks made at a post-mortem performed before the members of the third-year medical class of the University of Pennsylvania, March 6, 1893.

Presented by the author



height is sixteen the child is four lunar months old. The skin should be tight and not wrinkled; the color no longer red, but white, and the woolly hair should only be found covering the shoulders. The length of the hair on the head should be carefully estimated. In the normal state it is two to three centimetres long. The state of the fontanelles and the normal measurements of the head, which you will recall from your obstetrical studies, should be carefully noted. The pupillary membrane disappears from the eyes after the eighth month. The nose and ear should feel hard, not soft. The nails are hard and well formed and slightly overlap the fleshy portion of the hand or foot. The circumference of the shoulders is eleven to twelve centimetres, that of the trochanters nine to ten centimetres. In boys the testicles should descend in the seventh month of foetal life, and, therefore, the two testicles should be discovered in the proper situation. In females the labia majora should cover the clitoris and nymphæ. The epiphyses of the femur should also be examined, for the centres of ossification, the centre in the lower portion of the bone appearing at the end of the ninth foetal month.

In making the incision into the body go to the left of the umbilicus, so that the umbilical vessels will not be injured. These should then be carefully examined, after the abdominal parietes have been thrown back, for any signs of micro-organismal invasion. Do not forget to examine the hypogastric arteries, as inflammation may be found running downward instead of upward as is usually the case. The micro-organisms causing

this condition are the usual ones of suppuration and gangrene.

In examining the abdominal viscera you will be at once struck with the fact that the organs are relatively larger than in the adult. The liver and the vermiform appendix especially seem out of proportion to the size of the child. This is normal,<sup>1</sup> as the weight of the liver represents 2.77 per cent. of the body weight of the adult, while in the new-born child it is 4.39 per cent. I have seen the vermiform appendix in a babe measure a small fraction over three inches. In this connection it may also be worth mentioning that the brain weighs 14.34 per cent. of the body weight in a babe, while in the adult it is but 2.37 per cent; *per contra*, the weight of the muscles is in proportion of 23.4 per cent. of the body weight for the babe, to 43.09 per cent. for the adult.

It is usually desirable to eviscerate the body of the babe. This can readily be accomplished without making the incision higher than the inter-clavicular notch. In the first case, though it is easier done if the incision is made to the symphysis mentis, the skin is dissected internally, away from the trachea, and a sharp knife is introduced through the centre of the genio-glossus muscle, posteriorly to the frenum of the tongue, and a circular incision is then made, cutting close to the carotids, laterally and posteriorly, as close as possible to the bodies of the vertebræ. By this method the tip of the tongue will be left intact in the mouth, in case an investigation be made at this point. The posterior portion of the tongue, epiglottis, œsophagus, larynx, etc.,

<sup>1</sup> Vierordt, quoted by Ziegler.



are then grasped, drawn downwards and elevated, and the loose tissue is readily cut with a knife until the diaphragm is reached. This is then cut laterally and posteriorly, the adhesions again removed with the knife. The rectum is tied with two strings, and cut between the ligatures. Anything which holds the abdominal organs in place is cut, and the body of the babe is completely eviscerated. You will see at once, as I lift the thoracic organs up, how easy the method is. I cut loose the crura, and the diaphragm is free. In the case of a female, you can take the organs of generation (also the bladder), along with the other organs, by removing them in the manner with which you are familiar in the case of an adult. The advantage of this method is that the organs can be examined, most conveniently, both anteriorly and posteriorly, and, as all the organs are attached, the same relations are preserved as if they were left in the body. A child disemboweled in this manner can be kept for a long while, especially if the abdominal cavity be packed with a mixture of equal parts of bran and salt. A little white arsenic can be added with good effect to this mixture. The body can then be surrounded with cotton, and a circular bandage applied to the chest and thorax. You can sometimes advise the employment of this method as a means of gaining permission from a parent to hold the autopsy.

In the thorax you should pay especial attention to the thymus gland. This organ is well developed at birth, and reaches its full growth at the second year of life, and then diminishes in size until at puberty it has

almost entirely disappeared. It lies about an inch below the thyroid gland between the apices of the lung, in front of the trachea, and the large blood vessels of the heart, resting upon the pericardium. It is about normal, in position and size, in this case—one and a half inches long, and about seven-eighths of an inch across. Mistakes are frequently made at post-mortems on children, in regard to the location of this gland, as well as to its nature when found.

In the heart, pay especial attention to whether or not the foramen ovale and ductus arteriosus are patulous. Anomalies, especially those of the ventricular septum, should be carefully looked for, as they are of frequent occurrence. Inflammations of the valves are especially apt to occur upon the right side, on account of the direction of the foetal circulation. In examining the foramen ovale you are very apt, unless care be taken, to push the probe into the right dog's ear, instead of through the foramen.

One of the best signs of the establishment of respiration is, according to the lectures of Professor Guitéras, the deposit of uric acid crystals in the pyramids of the kidneys. These crystals have not yet been described except in children who have breathed. They can frequently be seen with the naked eye. You will notice that the kidney here is lobulated. This is normal, and may continue into adult life, where it may be mistaken for a healed syphilitic lesion or a hæmorrhagic infarct.

In children suspected to be syphilitic be careful to examine for osteochondritis of the long bones. This can readily be done, by cutting through the centre of the head of

the femur where it is composed of cartilage, by means of a knife, and then protecting the hand with a towel, the bone can be held with the hand as if in a vise, and the saw can accomplish the rest of the work.

The next point is the removal of the brain. This is much more difficult than in the case of an adult, first, because the brain is much softer, and, second, because the dura is adherent to the cranial bones; these two factors add to the difficulty of the task, but there is one that makes it more easy, namely, that the sutures are not ossified together. The brain in a new-born child is so soft that it is almost impossible to take it out without injury. A good method is to lay the child for a short while upon ice, upon which some salt has been sprinkled, in order that the brain may be hardened by the cold. I have secured the best results by placing the child in a large basin or tub of water, and the conducting of the final operations here, while the body is held under the water by an assistant. Instead of ordinary water you may use a solution of salt. Add a half bucketful of common salt to four or five bucketfuls of water; this makes the solution slightly above the specific gravity of the brain substance, and there is much less danger of injury to the occipital lobes if the brain be taken out in this fluid. You may make the same incision as in the case of the adult, namely, running the knife under the scalp across the head from mastoid process to mastoid process. The scalp is much more easily removed than in the adult. You will notice how readily it peels back. We have now exposed the cranium, and you will see that the sutures are not joined, and the fontanelles are

plainly to be seen. With a small saw I have sawed through the frontal and occipital bones, where ossification has already occurred; the rest of the cutting can usually be done with a pair of scissors or a knife. You then cut on each side of the longitudinal sinus and bend the bones to the side until they break and the brain is exposed, covered by the pia and arachnoid.

When you have sawed the bones, the body should be, preferably, in the salt solution. It is held by your assistant, and you remove the brain as in the adult, first, however, removing the falx cerebri and longitudinal sinus. You next press the brain back and remove, with great care, the frontal lobes, with the olfactory lobes; now cut the optic nerves, remove the pituitary body and the vessels, and expose the base. Cut the nerves and vessels long and sever the spinal cord as low down as possible. When the tentorium cerebelli and falx are cut through you can push the brain out upon the fluid. Its specific gravity will cause it to float, and if you desire to harden it a good plan is to place the jar filled with Müller's fluid under the brain. You can get the organ in the hardening fluid without much of the water or salt solution passing out. Afterward change the Müller's solution for a fresh supply.

You will rarely be called upon to remove the the cord. If done, it can be accomplished in the same manner as in the adult.

According to Virchow (translated by Smith), the following regulations are in force in Prussia for the guidance of medical jurists in conducting post-mortem examinations for legal purposes, in new-born children:

I. *Determination of Maturity and*



*Period of Development.*—In the post-mortem examination of new-born children special attention is to be directed to the following points:

In the first place, the signs indicative of maturity and period of development must be looked for.

These are: The length and weight of the child, the condition of the general integument and of the umbilical cord, the length and state of the hair of the head, the size of the fontanelles, the diameter of the cranium (longitudinal, transverse and diagonal), the condition of the eyes (*membrana pupillaris*), the state of the cartilages of the nose and ear, the length and condition of the nails, the transverse diameter of the body at the shoulder and hips; in male infants, the condition of the scrotum and position of the testicles; in females, the condition of the external organs of generation.

Finally, we must examine the size of the centre of ossification (if present) in the inferior epiphysis of the femur. For this purpose, the knee joint must be opened by means of a transverse incision below the patella, the joint fully bent and the patella removed; thin layers are then to be cut from the cartilaginous end of the femur, till the greatest transverse diameter of the centre of ossification (if present) be reached; this is to be measured in millimetres.

Should the condition of the fœtus be such as clearly to prove that it was born before the completion of the thirtieth week, it is not necessary to proceed further with the examination, unless the magistrate distinctly requires it.

II. *Determination of the Question whether the Child has Breathed.*—If

it shall appear that the child has been born after the thirtieth week, the next step is to ascertain whether it has breathed during or after birth. For this purpose the respiration test must be applied, and the proceedings conducted in the following order:

(a) Immediately on opening the abdominal cavity the position of the diaphragm is to be ascertained, with reference to the corresponding rib, and, on this account, in new-born children, the abdomen is always to be opened first, and afterwards, the thorax and cranium.

(b) Before opening the thorax a ligature is to be placed around the trachea above the sternum.

(c) The thorax is then to be opened, and attention must be paid to the degree of dilatation of the lungs, and their position dependent upon such dilatation, particularly with reference to the pericardium. The color and consistence of the lungs should also be ascertained.

(d) The pericardium is then to be opened, and its condition and that of the heart, externally, are to be ascertained.

(e) The cavities of the heart are then to be opened, and their contents to be examined, and the condition of the heart in other respects is to be determined.

(f) The larynx and that portion of the trachea above the ligature are then to be opened by means of a longitudinal incision, and any contents are to be examined.

(g) The trachea is to be divided above the ligature and removed, together with all the organs of the thorax.

(h) After removing the thymus gland and the heart, the lungs are to

be placed in a capacious vessel filled with clean, cold water, in order to test their buoyancy.

(*i*) The lower part of the trachea and its subdivisions are to be laid open and examined, especially with reference to their contents.

(*k*) Incisions are to be made in both lungs, and notice taken whether any crepitant sound be heard, and also with reference to the amount and quality of the blood issuing from these cut surfaces on slight pressure.

(*l*) Incisions are to be made in the lungs below the surface of the water, to see whether any air-bubbles rise from the cut surfaces.

(*m*) Both lungs are next to be separated into their lobes, and these are to be divided into several small pieces,

the buoyancy of each of which is to be tested.

(*n*) The œsophagus is to be opened and its condition ascertained.

(*o*) Lastly, in cases where it is suspected that air cannot gain access to the lungs, in consequence of the filling up of their cells and passages with morbid products (hepatisation) or foreign substances (mucus, meconium), the lung tissue is to be examined with the microscope.

In my opinion, babes are the most unsatisfactory subjects upon which you are called to perform a post-mortem. In over one-third of all such cases upon which I have made autopsies I have been utterly unable to assign a cause of death, other than inanition or malnutrition.